Computer Networks and the Internet

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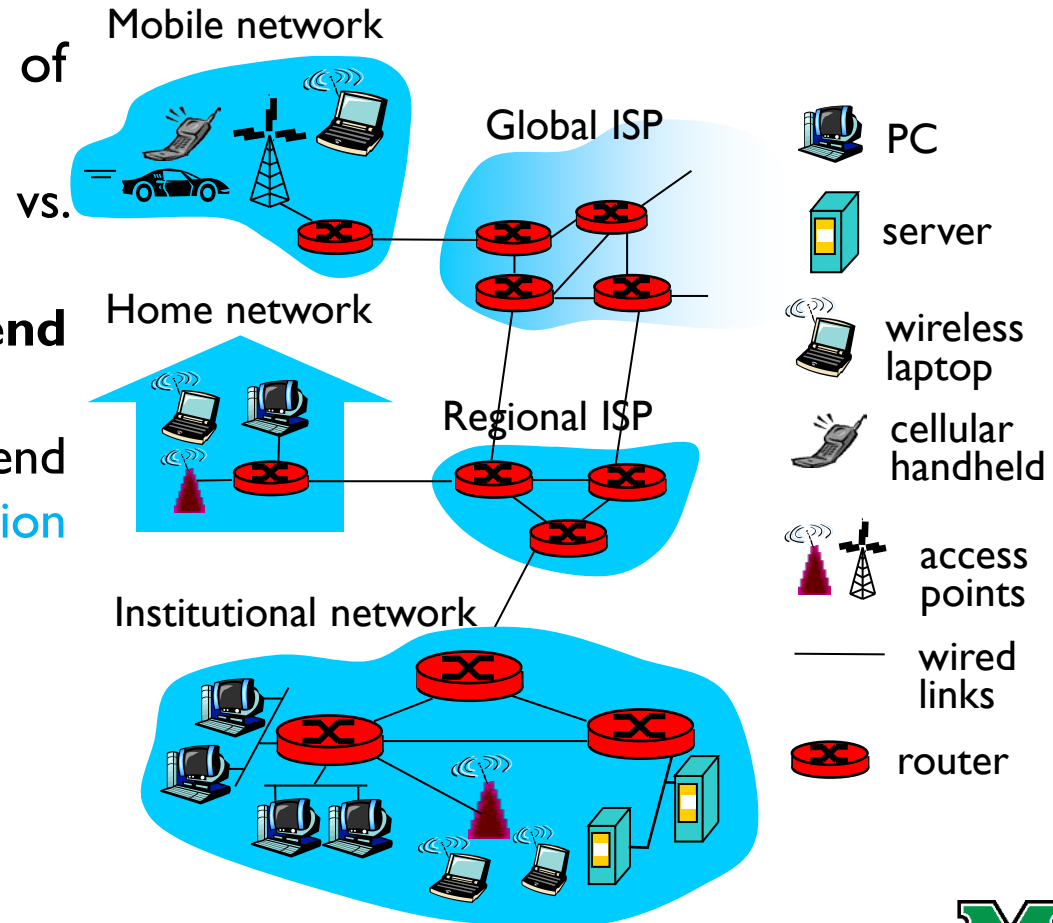Lecture 01

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What Is the Internet?

- Two ways to describe the Internet
  - The basic hardware and software components that make up the Internet

  - A networking infrastructure that provides services to distributed applications
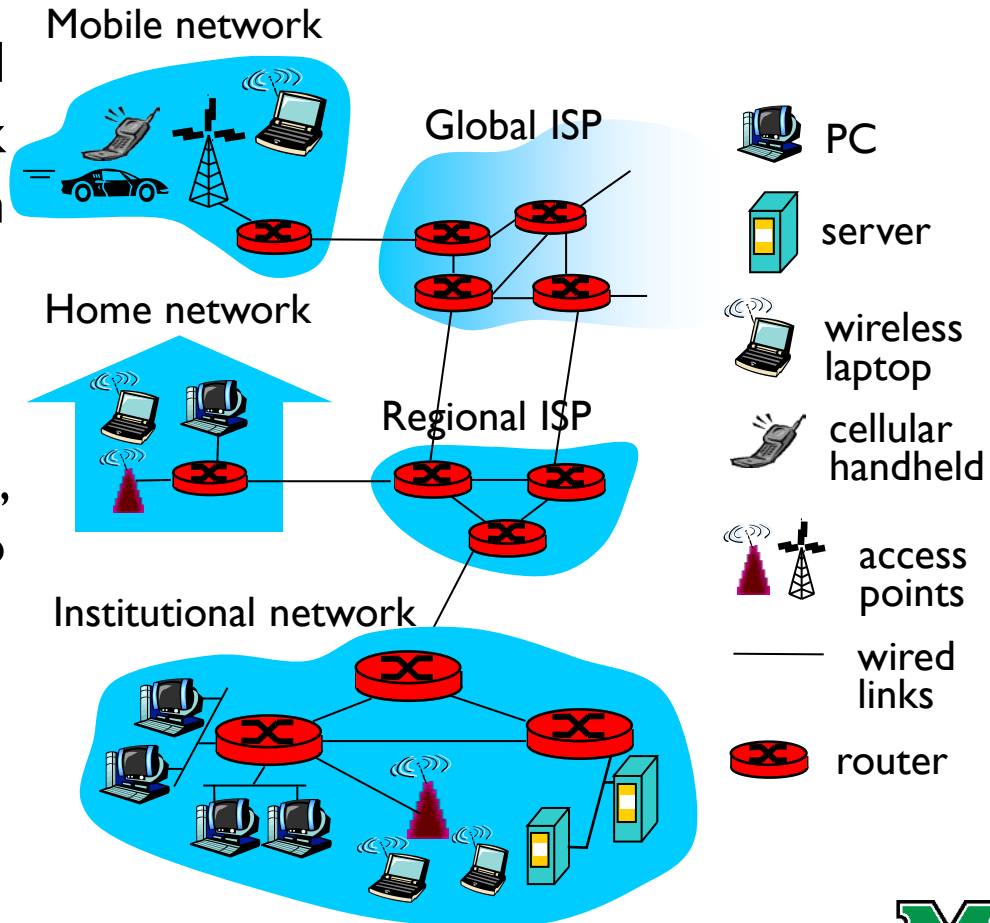
What Is the Internet: A Nuts-and-Bolts Description

- Hundreds of millions of computing devices
  - **Traditional** devices vs. **Nontraditional** devices
  - Devices = **hosts** or **end systems**
  - As of 2018, 22 billion end systems, and 4.021 billion Internet users

Mobile network

Global ISP

Home network

Regional ISP

Institutional network

PC

server

wireless laptop

cellular handheld
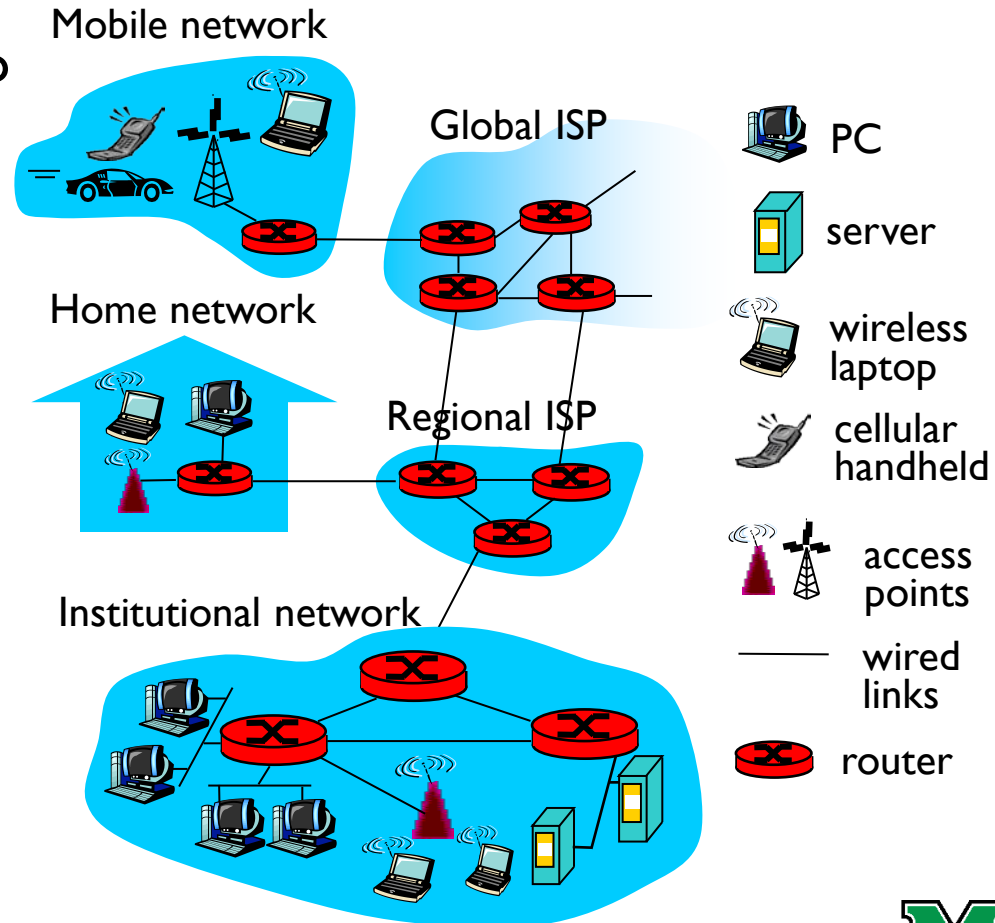
access points

wired links

router

What Is the Internet: A Nuts-and-Bolts Description

- End systems connected together by a network through **communication links** and **packet switches**

- Communication links
  - Coaxial cable, copper wire, optical fiber, and radio spectrum
  - **Transmission rate**: bits/second

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What Is the Internet: A Nuts-and-Bolts Description

- One end device sends data to another end device
  - sending device
    - segments the data
    - adds the header
    - send the **packet**

  - receiving device
    - receives packets
    - reassemble into data

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What Is the Internet:
A Nuts-and-Bolts Description

- **Packet switches**
  - Incoming links & Outgoing links
- **Types of packet switches**
  - **Routers**
    - Used in the network core
  - **Link-layer switches**
    - Used in access networks

- **Route** or **path**
  - The sequence of *communication links* and *packet switches*
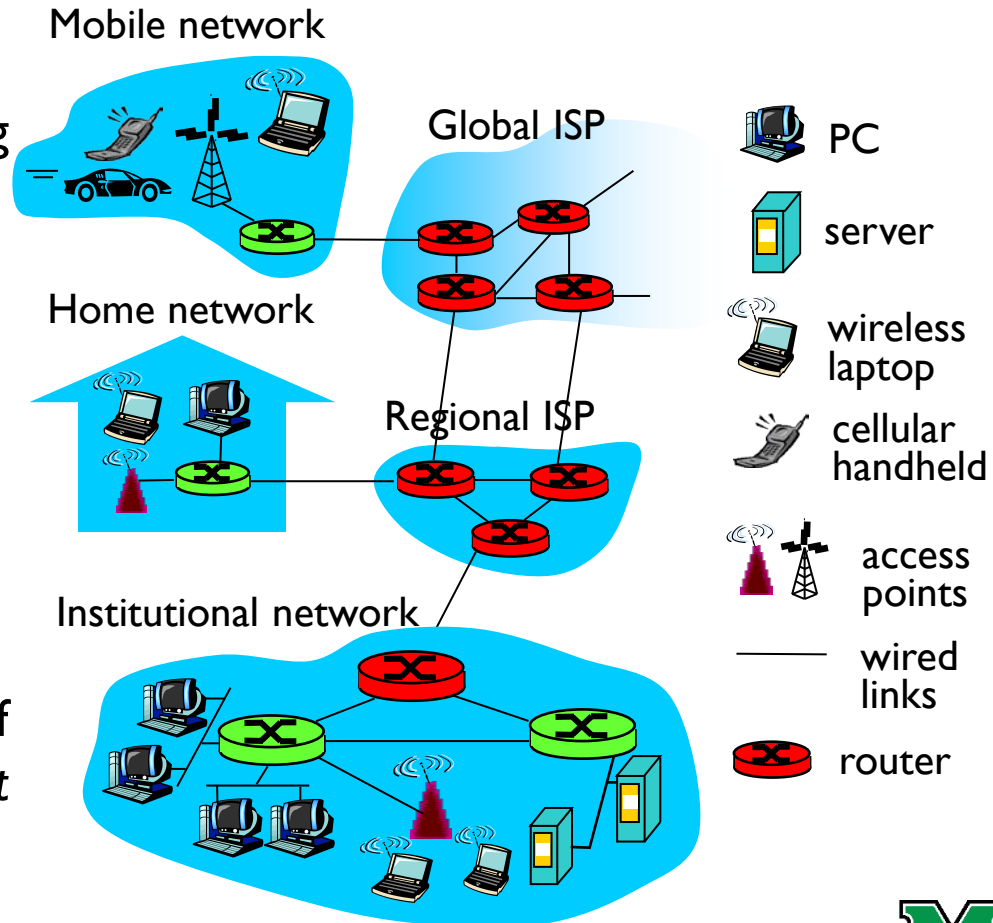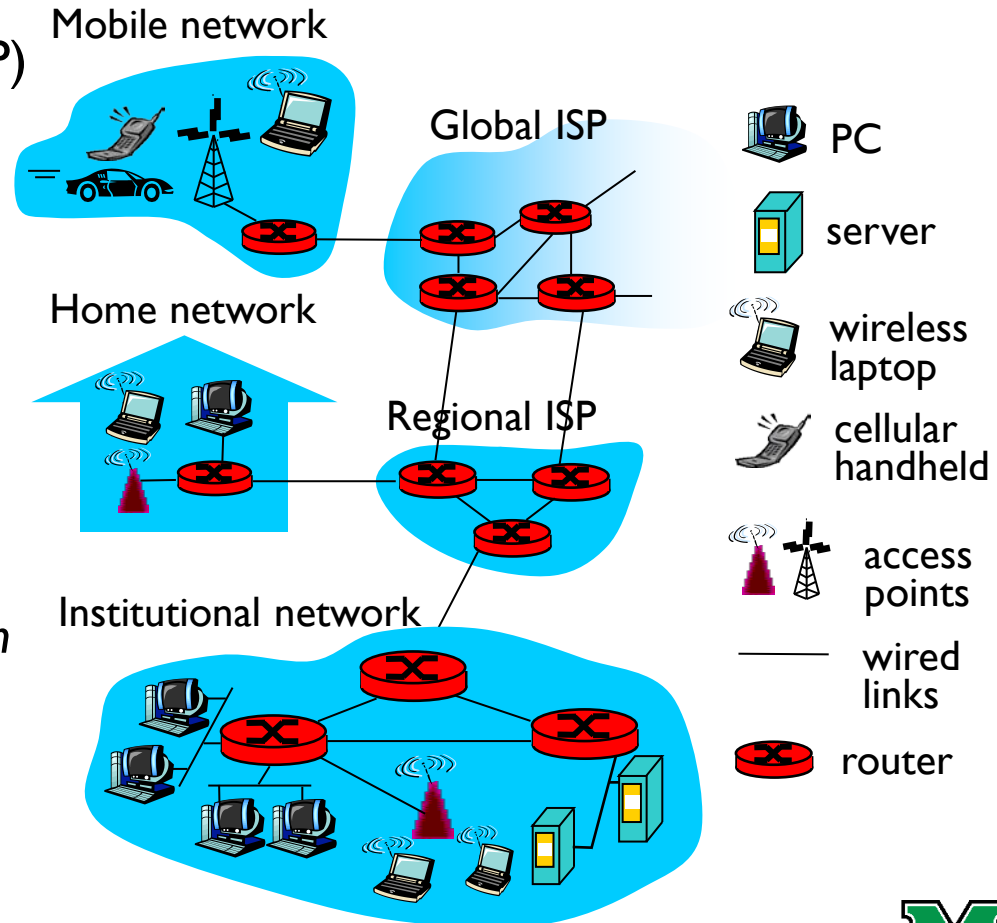
What Is the Internet: A Nuts-and-Bolts Description

- **Internet Service Provider** (ISP)
  - provide Internet access
  - different ISPs:
    - residential ISP
    - corporate ISP
    - university ISP
    - cellular data ISP
    - public ISP

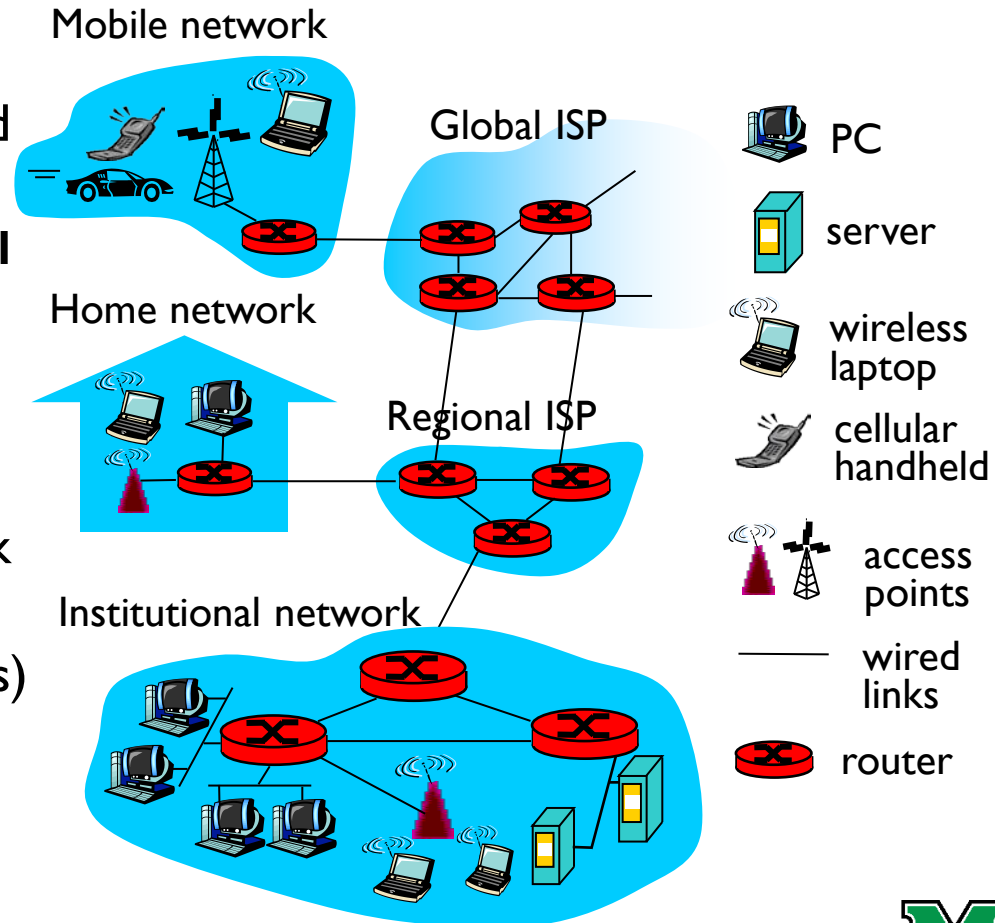- *packet switches + communication links = ISP*

What Is the Internet: A Nuts-and-Bolts Description

- **Protocols**
  - control the sending and receiving of information
  - **Transmission Control Protocol (TCP)**
  - **Internet Protocol (IP)**

- **Internet standards**
  - Internet Engineering Task Force (IETF)
  - requests for comments (RFCs)

What Is the Internet: A Services Description

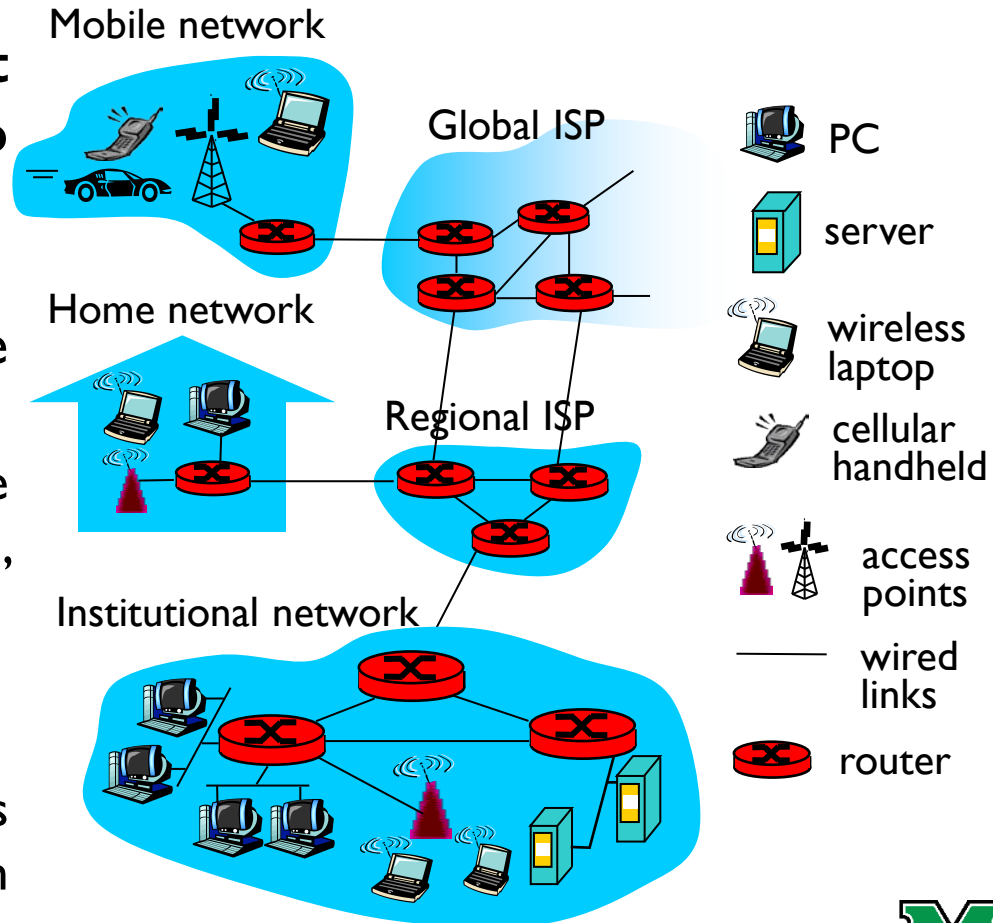*Internet apps run on end system, not in the packet switch.*

- **An infrastructure that provides services to applications**

- Communication infrastructure for distributed applications:
  - Web, email, mobile device apps, streaming, e-commerce, file sharing

- **Distributed applications**
  - involve multiple end systems that exchange data with each other

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Protocol

A protocol defines the format and the order of messages exchanged between two or more communicating entities, as well as the actions taken on the transmission and/or receipt of a message or other event.

## human protocols:

- "ask someone for the time"

… specific msgs sent

… specific actions taken when msgs received, or other events

Hi

Hi

Got the time?

2:00
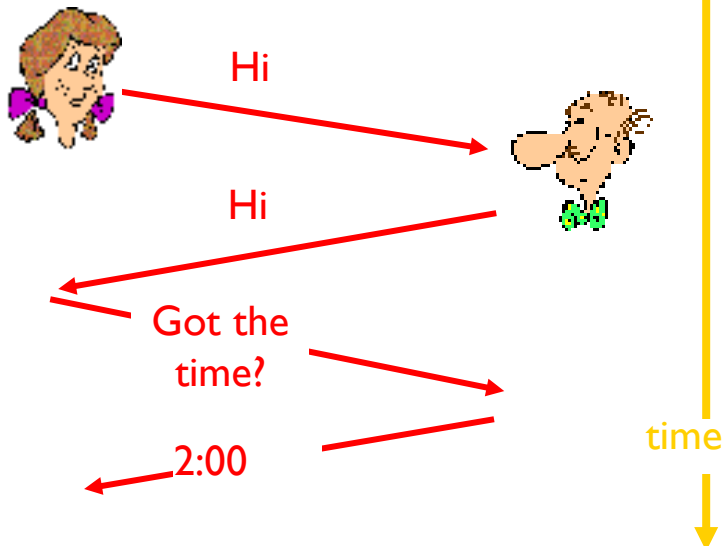
network protocols:

- machines rather than humans
- all communication activity in Internet governed by protocols
- "make a request to a Web server"

TCP connection request

TCP connection response

Get http://www.awl.com/kurose-ross

<file>

time
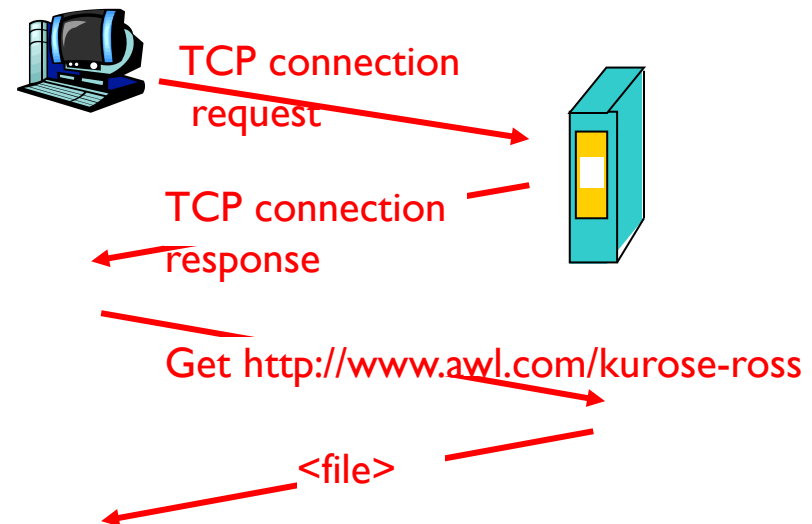
Q: a protocol for cutting a pizza equally?